

**Supplemental Table S1.** Assembly statistics overview for *Ca. Nitrotoga* genomes. Percent completeness and contamination were estimated using CheckM. The asterisks indicate manual assignment of some marker genes used in completeness estimates (see Supplemental Note).

	<b>Num. Contigs</b>	<b>GC %</b>	<b>N50 (bp)</b>	<b>Median Contig Length (bp)</b>	<b>Total Length (bp)</b>	<b>CDS</b>	<b>tRNA</b>	<b>rRNA</b>	<b>% Complete*</b>	<b>% Contamination</b>
<b><i>Ca. Nitrotoga</i> sp. CP45</b>	59	48.8%	69,731	35,034	2,816,237	2,665	36	6	99.8%	0.30%
<b><i>Ca. Nitrotoga</i> sp. LAW</b>	33	48.7%	123,222	58,971	2,814,534	2,676	37	6	99.8%	0.30%
<b><i>Ca. Nitrotoga</i> sp. MKT</b>	23	48.6%	214,834	70,433	2,707,194	2,526	39	6	99.8%	0.30%
<b><i>Ca. Nitrotoga</i> sp. SPKER</b>	32	47.5%	168,712	48,253	2,982,257	2,799	39	6	99.8%	0.24%

**Supplemental Table S2.** Summary table comparing key functions predicted within members of the major NOB groups.\*

<b>Predicted Function</b>	<i>Ca. Nitrotoga</i>	<i>Nitrospira</i>	<i>Nitrobacter</i>	<i>Nitrospina</i>	<i>Nitrococcus</i>	<i>Nitrolancea</i>
Terminal oxidase	<i>cbb<sub>3</sub></i> and <i>bd</i>	<i>bd</i> and <i>bd</i> -like	<i>aa<sub>3</sub></i>	<i>cbb<sub>3</sub></i>	<i>aa<sub>3</sub></i>	<i>aa<sub>3</sub></i>
Nitrate reduction	yes	yes	yes	<i>n.d.</i>	yes	yes
Carbon fixation	Calvin cycle	rTCA cycle	Calvin cycle	rTCA cycle	Calvin cycle	Calvin cycle
Heterotrophy	yes	yes	yes	yes	yes	yes
Formate dehydrogenase	no	yes	yes	no	yes	yes
Sulfite oxidation	yes	yes	no	yes	yes	no
Hydrogenase	yes	yes	<i>n.d.</i>	yes	yes	yes
Urea degradation	no	yes	no	no	no	no
Cyanate degradation	no	yes	yes	yes	yes	yes
Siderophore production	no	yes	yes	yes	possible	<i>n.d.</i>
Flagellum	yes	yes	yes	yes	yes	no
Quorum Sensing	yes	yes	yes	no	yes	<i>n.d.</i>
EPS Production	yes	yes	yes	<i>n.d.</i>	<i>n.d.</i>	<i>n.d.</i>

\*See review by Daims *et al.*, 2016 and references within.

*n.d.* refers to features that are uncertain or were not evaluated in the published references.

**16S\_rRNA\_gene\_accessions:**

JF429343.1  
GQ396987.1  
KM017113.1  
KM017124.1  
DQ640724.1  
DQ640694.1  
AJ421928.2  
AB826333.1  
EF520486.1  
AB753981.1  
JN626523.1  
AB753982.1  
KT778545.1  
AM086129.1  
HQ010836.1  
HQ158733.1  
KF945665.1  
JF828752.1  
EU234184.2  
JX040372.1  
FM174362.1  
KM017123.1  
KM017112.1  
KM017121.1  
DQ839562.1  
KM017127.1  
KM017126.1  
KF533805.1  
KF533752.1  
JN802683.1  
KM017118.1  
KM017128.1  
KM017125.1  
JX101441.1  
KM017116.1  
FJ263061.1  
KM017122.1  
KM017129.1  
KM017111.1  
FJ230913.1  
FJ230939.1  
KM017115.1  
KM017120.1  
KM017119.1  
FJ230941.1  
FJ230908.1  
FJ230940.1  
FJ230906.1  
KM017114.1  
EU244064.1  
KM017117.1  
GU061253.1  
AB247475.1  
KC551761.1  
GQ480074.1  
LC190436.1  
L07897.1  
DQ386262.1  
DQ386264.1  
DQ386858.1  
DQ386859.1  
FJ391492.1  
FJ391498.1  
JX308273.1

**Type II\_DMSO\_protein\_accessions:**

WP\_005557333.1  
KRT71940.1  
WP\_012964344.1  
OHB89378.1  
ARPS3735.1  
WP\_006671140.1  
WP\_005553455.1  
WP\_015320288.1  
WP\_090306927.1  
WP\_049927103.1  
WP\_008426537.1  
WP\_008895484.1  
WP\_012942830.1  
WP\_049923369.1  
WP\_013880708.1  
WP\_090615652.1  
WP\_007701576.1  
WP\_006652972.1  
WP\_071400145.1  
WP\_006166072.1  
AGBS3389.1  
WP\_006649791.1  
WP\_007142113.1  
WP\_089784439.1  
WP\_014030951.1  
WP\_015910069.1  
WP\_006671327.1  
WP\_012459851.1  
Q9S1H0.1  
P60068.1  
WP\_012173623.1  
WP\_028989412.1  
WP\_004513191.1  
KPQ43397.1  
EQB62431.1  
KRT68883.1  
WP\_012470696.1  
WP\_012662440.1  
WP\_005024327.1  
CAF21906.1  
WP\_011509502.1  
WP\_011511827.1  
WP\_041359063.1  
WP\_011314088.1  
WP\_011315305.1  
WP\_004998773.1  
WP\_005004540.1  
CHE67843.1  
WP\_012468292.1  
WP\_012132377.1  
WP\_000040373.1  
WP\_012017453.1  
WP\_011365654.1  
WP\_004512301.1  
CAA71210.2  
WP\_010877688.1  
YP\_430751.1  
CRI68048.1  
WP\_011344974.1  
WP\_011879804.1  
WP\_089723899.1  
OQY55899.1  
KCZ70344.1  
KMP11423.1  
WP\_048492943.1  
WP\_042250442.1  
WP\_042251421.1  
WP\_015257936.1  
WP\_018861559.1  
WP\_018868538.1  
WP\_018863956.1  
WP\_019624109.1  
WP\_040333786.1  
KJU86102.1  
KHE93157.1  
CAJ72445.1  
WP\_052562588.1  
WP\_096601733.1  
WP\_012513384.1  
WP\_052491869.1  
OQW90655.1  
ACL65121.1  
ACG72937.1  
GAO02124.1  
ABC81940.1  
WP\_09297472.1  
SNQ62035.1  
WP\_062483509.1  
CUS33249.1  
WP\_053378142.1  
WP\_053381280.1  
WP\_053381686.1  
WP\_053381689.1  
WP\_053381277.1  
WP\_080886776.1  
CUS31266.1  
WP\_080885591.1  
WP\_013249749.1  
WP\_013249767.1  
CUS38776.1  
WP\_080885705.1  
OHB90204.1  
Q8GPG4.1  
WP\_011223493.1  
AAO49008.1  
AFE03185.1  
Q47CW6.1  
WP\_018232354.1  
ASV74111.1  
AAK76387.1  
JQ279817  
JQ279818.1  
JQ279819.1  
JQ279820.1